# *Baseline Mapping of Solid Waste Management in Four Coastal Villages of Ramanathapuram*

INTERNSHIP REPORT

**THE UNIVERSITY OF TRANS-DISCIPLINARY HEALTH SCIENCES AND TECHNOLOGY (TDU)**
**&**
**ASHOKA TRUST FOR RESEARCH IN ECOLOGY AND THE ENVIRONMENT (ATREE)**

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MSc IN ENVIRONMENTAL STUDIES (CONSERVATION PRACTICE)

*Anooja A*
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UNDER THE GUIDANCE OF

*Shamili Mohanakannan (Host Supervisor)*

Project Coordinator, Dakshin Foundation, Bengaluru

*Dr. Shrinivas Badiger (ATREE supervisor)*

Fellow at the Centre for Environment and Development,

Ashoka Trust for Research in Ecology and Environment, Bengaluru

# Certificate

This is to certify that the "Baseline Mapping of Solid Waste Management in Four Coastal Villages of Ramanathapuram" submitted by Anooja A (2021MSCES04) is the work done by her submitted during the 2022-2023 academic year, is in partial fulfilment of the requirements for the award of the degree of MSc Environmental Studies (Conservation Practice).

Shamili Mohanakannan (Host Supervisor)
Dakshin Foundation, Bengaluru
Date: 8th August 2023
Place: Palk Bay, Ramanathapuram

Dr. Shrinivas Badiger (ATREE supervisor)
Ashoka Trust for Research in Ecology and Environment, Bengaluru
Date: 8th August 2023
Place: ATREE, Bengaluru

# Declaration by the student

I certify that

- The work contained in the report is original and has been done by myself under the supervision of my supervisor.
- The work has not been submitted to any other Institute for any degree or diploma.
- I have conformed to the norms and guidelines given in the Ethical Code of Conduct of the Institute.
- Whenever I have used materials (data, theoretical analysis, and text) from other sources, I have given due credit to them by citing them in the text of the thesis and giving their details in the references.
- Whenever I have quoted written materials from other sources and due credit is given to the sources by citing them.
- From the plagiarism test, it is found that the similarity index of the whole internship report is less than 10% as per the university guidelines.

Name of the student: Anooja A
Regd. No.: 2021MSCES04
Date: 8th August 2023
Place: Bengaluru, Karnataka

# I. ACKNOWLEDGEMENT

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## III. LIST OF ABBREVIATIONS

ATREE- Ashoka Trust for Research in Ecology and Environment
CPCB- Central Pollution Control Board
EPA- Environmental Protection Act
EPR- Extended Polluter Responsibility
FGD- Focus Group Discussion
MCC- Micro-composting Centre
MoEFCC- Ministry of Environment, Forests and Climate Change
RFTU- Ramnad Fishworkers Trade Union
SPCB- State Pollution Control Board
SWM- Solid Waste Management
SWOT- Strengths, Weaknesses, Opportunities and Threats
TDU- University of Trans-Disciplinary Health Sciences and Technology
TNPCB- Tamil Nadu Pollution Control Board

## IV. ABSTRACT

This study aims to understand the underdocumented solid waste management practices in four coastal villages of Ramanathapuram- Olaikuda, Thanneer Ootru, Morepannai and Karangad. Household waste audit, waste collection, recycling, plastic waste material flow composting and dumping were mapped. None of the villages has a daily waste collection. Thangachimadam panchayat showed the most efficient form of waste management. The biggest threat of improper SWM practises was to the villages' public and environmental health. Issues and concerns of the villages' solid waste management practices were studied using semi-structured interviews and Focus Group Discussions. Sankey Flow Chart and QGIS Maps are visual tools used to map the plastic material flow chain in Rameswaram island and Uppur village. Gender role in household waste management was studied as the FGDs were all-female volunteers to talk about waste production in villages. SWOT analysis and QDA Miner Lite software were qualitative analysis tools to better understand the SWM scenario and generate a report on the status of solid waste management in the study areas. The baseline mapping helps understand human behaviour around

waste segregation, generation and disposal at a village level, crucial for planning interventions to improve public and environmental health in a local context.

## V. INTRODUCTION

In the words of Thangachimadam's Panchayat President, "plastic mattum dhan prachanaye" (plastic is the only trouble).

Current solid waste management (SWM) practices in India are inefficient- they hurt public health, the environment and the economy (Kumar et al., 2017). While the country's landfills are competing with skyscrapers, the methane production from the unsegregated landfill waste along with livestock, agriculture and sewage contributes to India being the 2$^{nd}$ largest methane emitter in the first half of 2022 (Anushka Raychaudhuri, 2022).

The Policy Brief on "Solid Waste Management in Developing Asia: Prioritizing Waste Separation" by ADB Institute mentions that waste needs to be seen as a resource in growing and developing Asia, as it can generate 10-35% of savings. This figure applies especially to areas experiencing fast urbanisation, producing overwhelming amounts of waste. Even rural areas cannot escape the unmanageable waste generation caused by indiscriminate market-based growth and consumerist culture. Waste generated by households and institutions in villages is not segregated in situ. 0.3-0.4 million metric tonnes of wet waste is generated per day in the villages. Even if the solid waste mainly comprises organic and biodegradable waste (or wet waste), improper waste management causes poor environmental sanitation and affects public health (*Solid Waste Management in Rural Areas: A Step-by-Step Guide for Gram Panchayats*, 2016).

Swacch Bharath Mission's commitment demands scientific disposal of waste by rural households, next to them becoming open-defecation-free villages. The Step-by-step guide for Gram Panchayats created by the National Institute of Rural Development and Panchayati Raj says that the financial return on investment is very low but gram panchayats must continue practising it to fulfil the dream of "clean and green villages". Most ragpickers are destitute

migrants and the guide recommends hiring such people. This was observed in the villages covered in the study. This process is unfair as they go unrecognised and unpaid in most cases (Spend, 2017).

The Step-by-step guide for Gram Panchayats created by the National Institute of Rural Development and Panchayati Raj also mentions how villagers must practice reducing, reusing and recycling and one process to help with that is recycling dry waste like plastics, paper and cardboard which the waste collectors can sell to the recyclers. Such a system exists in Ramanathapuram district, and three out of four villages practice recycling their dry waste through private plastic recyclers. Moreover, there has been one notable case of a notice to PepsiCo served by the Ramanathapuram Municipality Commissioner, S Parthasarathy under Extended Producer Responsibility (EPR) of Plastic Waste Management Rules 2016. PepsiCo said it will collect back the plastic waste that is generated by its products in Tamil Nadu. Such notices push private companies to register with CPCB and start making a move to dispose of their brand waste without causing damage to the environment (Thinakaran Rajamani, 2018).

The baseline study attempts to understand household waste production, waste recycling system and roles and responsibilities of three panchayats and a municipality of four coastal villages of Ramanathapuram. The study is part of the Palk Bay project by the Dakshin Foundation, Bangalore, which works to strengthen fishing communities' well-being and conserve coastal ecologies. The four study villages are Karangad, Morepannai, Thanneer Ootru and Olaikkuda. Karangad and Morepannai are on the mainland while Thanneer Ootru and Olaikkuda are on Rameswaram island. They were selected after consulting with key informants in Ramanathapuram District, including the District Commissioner and activists of an organisation called RFTU (Ramnad Fishworkers Trade Union).

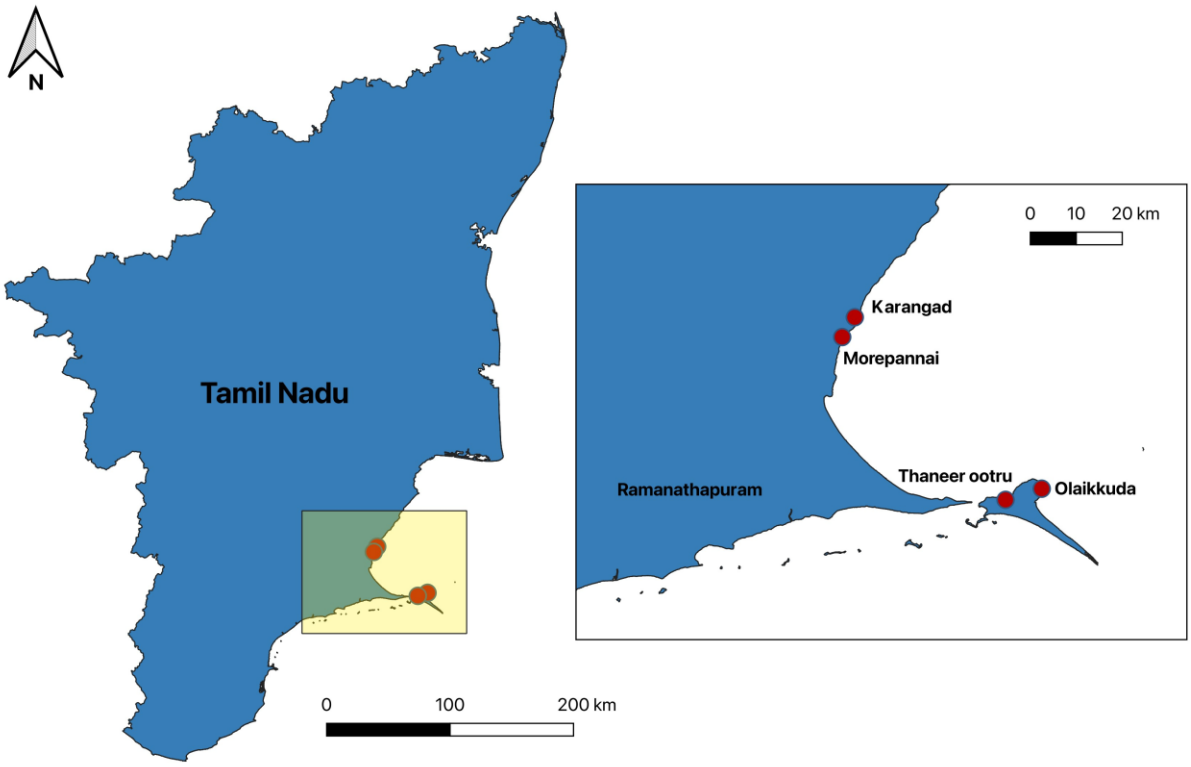


*Figure 1: Baseline mapping of solid waste management practises in four coastal villages of Ramanathapuram.*

A mix of qualitative research tools was used to conduct this baseline study such as semi-structured interviews and focus group discussions.

In India, the Union Ministry of Environment, Forests and Climate Change (MoEFCC) have the responsibility of regulating and managing waste while the Central Pollution Control Board (CPCB) and the State Pollution Control Board (SPCB) implement the rules laid down by the MoEFCC. The Environmental Protection Act 1986, (EPA 1986)'s objective is to provide for the protection and improvement of the government. EPA 1986 gives CPCB authority the power to prevent environmental pollution and tackle environmental problems.

For Tamil Nadu, we have CPCB and Tamil Nadu Pollution Control Board (TNPCB) managing all kinds of waste, including solid waste and plastic waste (*Environmental Protection Act, 1986,*

n.d.). CPCB brought in the Solid Waste Management Rules 2016. Just one plastic waste recycler unit is listed for Ramanathapuram District while Chennai has 45 on the TNPCB official website (*TNPCB Waste Management*, n.d.). The study tries to understand how the governing bodies responsible for solid waste management, namely the panchayats and the municipalities, work in the four study village areas of Ramanathapuram District.

Solid waste management and plastic recycling are not documented well in rural areas. There is no direct role of the central government in village panchayats– even TNPCB's jurisdiction covers only till town and Nagar panchayat (*TNPCB Waste Management*, n.d.). The waste collection from small villages with a population of an average of 400 families falls upon the village panchayat. The study hopes to bring light to the understudied solid waste management practices in rural Tamil Nadu and generate baseline data to understand the challenges of the system better while being mindful of the villagers' and environmental health.

## VI. DESCRIPTION OF INTERNSHIP (Activities, Routines, and Tasks)

The study observes the following objectives across the four field sites– Olaikuda, Thanneer Ootru, Karangad and Morepannai.

1. Perform household waste audits in four model coastal villages.
2. Map plastic recyclers in Rameswaram and understand the plastic value chain in four model coastal villages.
3. Understanding the roles and responsibilities of panchayats and municipalities in solid waste management of the four model coastal villages.

### ACTIVITIES AND TASKS:

To understand the solid waste management practices in coastal villages of Tamil Nadu, initial scoping visits were done where unstructured interviews were conducted randomly in each village

to understand the demographics. Unstructured interviews were also conducted with researchers in Dakshin's Palk Bay team from which key informants of each village and a broad picture of the village was obtained, covering the key informants, a few recyclers contacts and the location of the panchayats/municipality offices. The four villages were selected as they practised artisanal fishing and predominantly had fishing communities residing. Research on Community and Resource Governance of Coastal Ecosystems is being done in the four villages by Dakshin Foundation's Palk Bay team.

Huge amounts of waste are caught in the fishing nets of the artisanal fisherfolk. Another phenomenon observed is plastic getting beached. Rameswaram has a high tourist' floating population, who are key contributors to plastic pollution on the island. This has generated a whole new sector of plastic waste recycling chain, which is so well known that people from neighbouring towns like Paramakudi migrate to become plastic recyclers near these village areas. Snowballing sampling was used to identify these recyclers- from the waste collectors to the waste processors.

16 semi-structured interviews with plastic recyclers were conducted to get an insight into the plastic value chain. All interviews were in Tamil, as most of them spoke only that language. Waste recyclers deal with dry waste that includes plastic, paper, cardboard, rubber, metals and appliances. The study used QGIS to map the private waste recyclers to get a better visual understanding of plastic recycling and its distribution. Wet waste was the majority composition of waste generated by the villages, which is usually thrown in the backyard to feed their garden and goats, or taken by the municipality which sends wet waste to a micro composting centre (MCC). This information was gathered via the Focus Group Discussions (FGD) conducted in each village.

FGD was held at each study site and recorded with every participant's consent to understand the production of household and small-level commercial waste in the villages. The members for the discussion and a hall were arranged by the key informants of their respective villages. A questionnaire was developed for the FGDs and with the help of a few women participants who

translated a few English words into the local language, the entire discussion was conducted in Tamil.

Semi-structured Interviews were held with representatives of Karangad Panchayat (for Karangad village), Kadalur Panchayat (for Morepannai village), Thangachimadam Panchayat (for Thanneer Ootru village) and Rameswaram Municipality (for Olaikuda village). The questionnaire was formed to understand their roles and responsibilities in terms of solid waste management of the specific villages. Moreover, this was the start of building a long-term partnership with the villages for future outreach activities including beach and village cleanups, school engagement and potential collaborations with other stakeholders to improve public health and awareness of healthy SWM practices. One such awareness programme was conducted during the study at Government Higher Secondary School, Mandapam. Children were shown how segregation can prevent our wastes from going to landfills, incinerators and oceans along with a hands-on school cleanup activity followed by learning to segregate

## VII. REFLECTION/DISCUSSION OF SKILLS GAINED

This was my first long fieldwork on sociology and I learnt a whole new set of skills. Pitching ideas, getting funds for field expenses, managing field finances, generating question cues, conducting Focus Group Discussions, talking and interacting with people, speaking Tamil, managing time, arranging and planning activities, collaborating with field station teammates to improve my interpretation and analysis of data, maintaining a good relationship with key informants, and most importantly, being humble on the field and conducting scientific field research. While interviewing people, I learnt to make efficient field notes, upload translation and transcription of the audio files on time, upload pictures on time, document each field data collection in neat folders and analyse regularly as and when the interviews happen, discussing with peers to understand different possible perspectives on same data, using QDA miner lite software to analyse large qualitative data sets, presenting my field learnings and diaries, writing a report.

When an informal waste picker exclaimed “indha kuppai dhan engaloda kanji!” (this garbage is our porridge), which means that waste is their source of income, it struck me hard. The underprivileged forage waste to find food. I thought little about the waste I generate and the people managing waste before joining this project- about how urbanisation and consumerism generate waste invariably. This made me look at the impacts of our every little action. Outreach and communication is the need of the hour as a basic source-segregation of waste can go a long way in making waste worker’s job easier, which is why we conducted a workshop for government school children in Ramanathapuram for the same (Vij, 2012).

A lot of large plastic recyclers were tight-lipped about their recycling process and there is a lack of complete transparency on what happens to the dry waste collected from Ramanathapuram scrap dealers. Few scrap dealers consider the interview a threat to their business. I learnt to deal with this by being candid with them and reassuring safety of the data collected and the complete anonymity of the respondents on my report without causing them too much of a bother.

Safety on the field is a huge concern, as we work mostly in foreign lands, and we are foreigners to the locals of the field sites. As a woman working in the field, we face different struggles including getting glared at the whole two-hour bus ride and catcalling. At one instance, a big local plastic recycler asked me about my marital status. What I found helped is finding a network of other women on the field, identifying safe people, talking about the issues and prioritising mental health (*Why Is Fieldwork Still A Roadblock For Women In Science?*, 2023).

Engendering conservation is essential and one gender issue that stood out the biggest to me during my fieldwork was having all-female members for four FGDs on household waste management. Context is that I had asked the village’s key informants to arrange a meeting with randomly selected village members to get a broad picture of the SWM of their village and they brought an all-female team to answer questions about waste management. This shows how women are expected to perform tasks that are not considered “productive” while males do productive work to bring bread to the table that does not involve segregating and throwing their waste (*The Role of Gender in Waste Management*, 2019; *Trapped in a ‘Reproductive Economy’,*

*Most Women Can't Access Property*, 2023). Data analysis in this study has been done with such gender disparities noted.

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Personally, one of my biggest struggles was to get a work plan set, as I received little support from the host organisation. It affected my motivation during the initial days of my fieldwork. Coupling that with extreme heat on the field, I faced physical health issues as well. One of the toughest things to do during such a time is to ask for help. With help and accepting my capacity I could form a functional work plan and complete all my assigned tasks successfully. I hope such help is accessible to not just me but everyone working in the field to make the world of research an easier and more accessible one.

# VIII. SUMMARY AND CONCLUSIONS

## 1. VILLAGE PROFILING AND HOUSEHOLD WASTE AUDIT

All four study villages are coastal villages with artisanal fisherfolk communities living. The major religion practised is Christianity, followed by Hinduism and Islam (refer to Annex I). There is no visible data on the amount of waste produced in each village of Ramanathapuram district. Solid Waste management data is found for Ramanathapuram Municipality and Rameswaram Municipality, not for any other villages of the study sites ("Solid Waste Management," n.d.-a; "Solid Waste Management," n.d.-b).

### a) Waste generation:

In the four villages, kitchen or wet waste comes to 0.25-0.5 kg per day. The women in FGD described wet waste as "one handful" or "two handfuls" which was roughly estimated to be around 250 grams. Sanitary waste is burnt by panchayat workers or household members or is dumped away on the road. Monthly an average of 2 HDPE bottles is used. During summer, PET bottle waste generation increases. Daily plastic waste generation includes masala packets, oil packets, milk packets, PET bottles, biscuit packets, snack packets, chocolate wrappers, shampoo packets and detergent packets. Very rarely they dispose of mixi (blender-grinder) and TV that no

longer runs. There is negligible paper waste produced. Across all four villages, an average of 1-tonne dry waste and 5.75-tonne wet waste is produced monthly.

There are two limitations to understanding waste generation in the four villages. The waste generation data is collected from the FGDs conducted in the four villages. Through oral description, there can be errors in the calculation of monthly household waste generation based on differences in perception of the quantity of waste generated by different communities. Moreover, this figure does not include the disposal of fishnets. Fishnet recycling is done by private recyclers who exclusively deal with fishing nets in each village. When Sun Polymers was approached to understand the collection of discarded fishing nets and the recycling process, no answers were given. FGDs focussed on waste generated from houses and small commercial shops in the villages. Each fishing net lasts 3 months on average. The discarded nets are collected by either fish net sellers or fish net recyclers which is part of a separate recycling chain from the general plastic and dry waste generation in Ramanathapuram District. This brings to another limitation- there is not enough data collected on the fishing nets recycled in the villages.

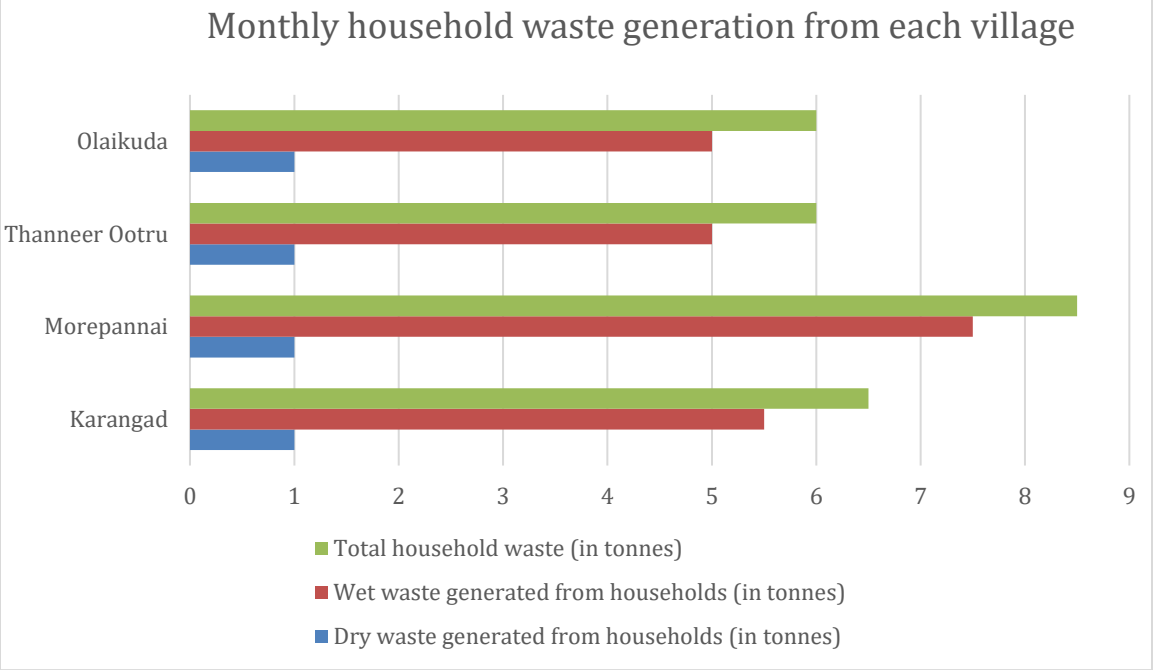


*Figure 2: Weight of monthly household waste generated in four study villages (in tonnes). Morepannai generated the highest amount of weight but it is the village where almost no*

*panchayat waste collection and management has happened in the past few years. Thanneer Ootru is the only village with regular (weekly once) panchayat waste collection.*

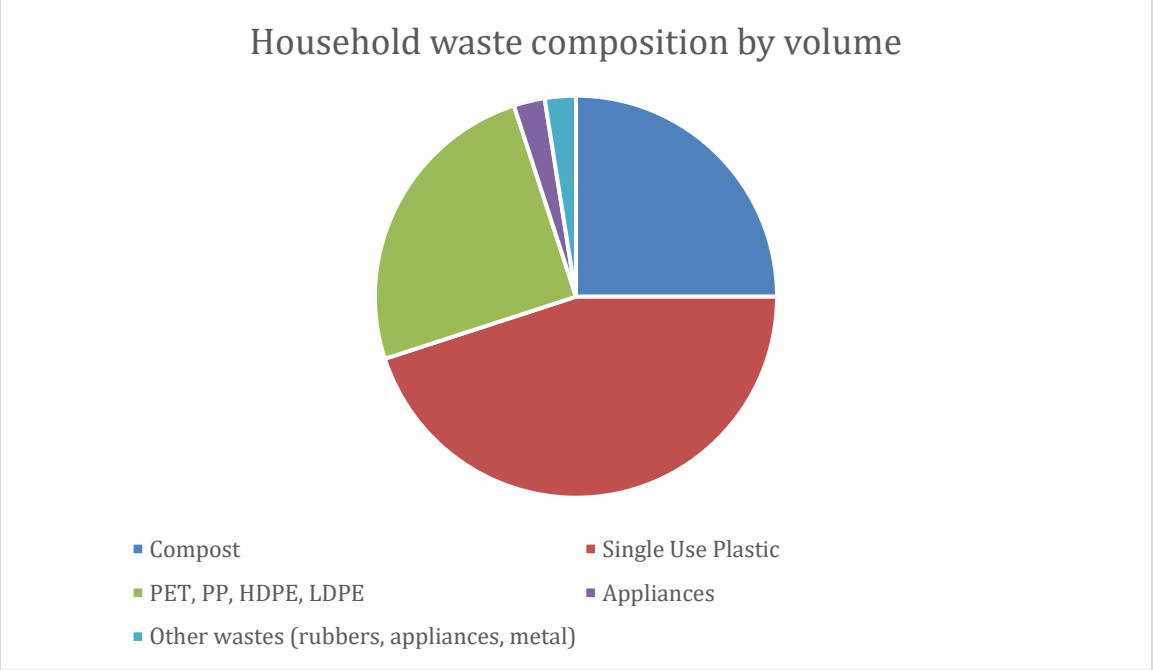


*Figure 3: Volume of different wastes generated by households of the four study village areas as reported by the females of the households in the FGDs.*

b) Waste collection:

In Karangad there is no collection by municipality- the panchayat and MNREGA workers collect and place waste in the collection centre but the Thiruvadanai municipality has not collected it for a long time. Villagers end up burning waste or dumping it. Morepannai villagers dump waste in pockets near their households. Thanneer Ootru has a weekly collection of waste by Thangachimadam Panchayat. Olaikuda villagers burn their waste.

There are community dustbins present in all villages except Morepannai. Waste collection happens in Thanneer Ootru. In Olaikuda and Karangad, there is nearly zero waste collection from the municipality from the community dustbins. One of the main complaints raised in the FGD was that people generally dump around the dustbin and not inside it. Ragpickers collect plastic waste and sell it to local scrap shops. Villagers mentioned that most of the ragpickers migrated to their villages to earn money by collecting plastic waste. Big scrap shops have vans

which ride through all three villages except Morepannai for waste collection. Waste collector profiling has been done under section 2. A. The transportation of waste occurs mostly through tricycle carts (Panchayats and private carts) and private vans.

There are dumping grounds inside the village, and huge dumpyards in the district managed by different municipalities including Rameswaram Municipality and Ramanathapuram Municipality. The segregation is done manually at the municipality/panchayat dumping grounds and/or scrap shops. Most of the waste collectors and segregators press on the importance of source segregation, the lack of which is one of their biggest issues.

A SWOT analysis (Table 1) was done for waste collection, segregation, transportation, dumping and composting activities in each of the study areas to understand the SWM scenario better.

| Location | No. of families | House-hold Size | Strengths | Weaknesses | Opportunities | Threats |
|---|---|---|---|---|---|---|
| `Karangad | 375 | 4 | Active participation by villagers, women leaders, infrastructure | Low wages to waste collectors, Municipality not visiting frequently to collect waste | SHGs (composting), awareness programmes on segregation | Public Health, Environmental Health |
| Morepannai | 630 | 5 | Population, active participation of women, strong vocal leaders | Lack of labour, lack of infrastructure, littering on the beach and in the sea | SHGs (composting and recycling as private recyclers do not visit here), awareness programmes on segregation | Public health, Environmental Health |
| Thanneer Ootru | 300 | 4 | Efficient panchayat waste management system with infrastructure | Tourist-generated waste, roadside littering, Low income for panchayat waste pickers (Rs. 3600 is the standard salary) | SHGs (composting), awareness programmes on segregation | Public Health, Environmental Health |

| | | | | | | |
|---|---|---|---|---|---|---|
| Olaikuda | 300 | 7 | Awareness of villagers, good participation strength in govt-lead programmes | Municipality not visiting frequently to collect waste, waste bins present but not used | SHGs (composting), awareness programmes on segregation | Public Health, Environmental Health |

*Table 1: SWOT analysis of municipal solid waste management practises of the four villages. The number of families and household size is sourced from Marine Fisheries Census 2016.*

a) Waste recycling:

In Karangad, Thanneer Ootru and Olaikuda, the dry waste is collected by plastic recyclers from every alternate day to daily thrice. There is no such collection happening in Morepannai. The reason has to be explored. A recycler from Uchipuli who collects Karangad and neighbouring villages of Morepannai was asked if there is any collection at Morepannai, and he responded by saying he doesn't know about Morepannai. A fishing net is recycled well across all four villages as they are all artisanal fishing villages with buyers having seller's or fishing net recycler's contacts. In Olaikuda, the fisherfolk have made a notable replacement of plastic floaters of the fishing nets with biodegradable ones made using Calotropis fibre.

b) SWOT Analysis:

- Strength:

A strength, weakness, opportunities and threats (SWOT) analysis was done based on the FGDs conducted. Each study village had its unique strengths. In Karangad, there is active participation by villagers, especially female leaders. They have a good waste management infrastructure as a waste collection centre exists in the village. An ecotourism centre is managed by a female. The most populous study village with 630 families is Morepannai and its strength includes having active women's participation, with 29 women of the village coming in for participating in the FGD.

Thanneer Ootru has the best waste management system as the Thangachimadam Panchayat who is managing it collaborated with Hand-in-Hand NGO (Vasudeo et al., n.d.).

Olaikuda has strong women's participation in the growth and development of the village. During the FGD, a session on the leadership programme on Seagrass Cultivation by Govt of India was happening (in June 2023).

- Weakness:

Low wages for waste collectors exist across all four study villages which brings in a lack of labour along with other socioeconomic reasons. All panchayats reported that there is a lack of funds which is why they are not able to collect waste at all, if not daily. There is ignorance from the governing bodies responsible for SWM of Karangad, Morepannai and Olaikuda.

- Opportunities:

Across all the villages, making compost with the help of SHGs and active volunteers has high potential and use it for their land/farms or earn by selling the compost. There is also an opportunity to conduct awareness campaigns on segregation and waste management.

- Threats:

Due to no daily waste collection, unscientific dumping and burning of waste, and dump yards being close to the households, this presents a threat to the public and environmental health.

c) Semi-structured interview with Panchayats and Municipalities of Ramanthapuram District:

1) Karangad's Governance:

The government has provided the villagers with garbage bags and gloves to collect waste but there is no budget allotted for daily waste collection. Moreover, the municipality does not collect waste from the village. One respondent from Karangad FGD is one of the five government-appointed waste collectors and a resident of the village. She usually works every Sunday, collecting household waste and segregating it at the village waste collection centre near the

beach. Nowadays the municipality does not come to collect waste from the collection centre. Another respondent said, “Two vehicles are provided for municipal waste collection from the waste collection centre but there is no one coming now citing tyre puncture.”

2) Morepannai’s Governance:

Morepannai comes under Kadalur Panchayat. Upon interviewing one of the panchayat members, it was found out that 6 villages are coming under the panchayat’s jurisdiction. Only seven people are working across the six villages to collect waste, making the workload a whopping 120 houses/worker. There is no practice of household segregation and the waste collectors struggle to collect and segregate it. Moreover, the municipality that is in charge does not seem to collect waste from the panchayat.

3) Thanneer Ootru’s Governance:

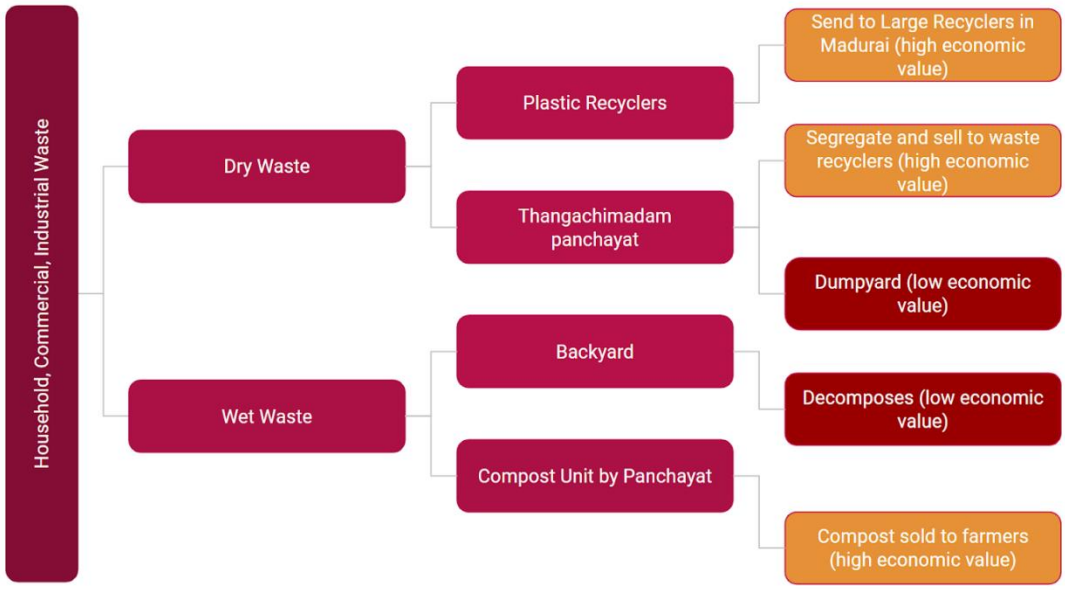
Household, Commercial, Industrial Waste
Dry Waste
Wet Waste
Plastic Recyclers
Thangachimadam panchayat
Backyard
Compost Unit by Panchayat
Send to Large Recyclers in Madurai (high economic value)
Segregate and sell to waste recyclers (high economic value)
Dumpyard (low economic value)
Decomposes (low economic value)
Compost sold to farmers (high economic value)

*Fig 4: An overview of SWM in Thanneer Ootru, driven by the Thangachimadam Panchayat*

Thanneer Ootru comes under the jurisdiction of Thangachimadam Panchayat. The panchayat’s interview was taken. There are 13 villages, and weekly collection occurs in each village. By far,

Thangachimadam panchayat has done the best job in managing the solid waste of their villages. Reasons for it include but do not restrict to strong leadership by the Panchayat President and involvement of Hand-in-Hand NGO.

In Rameswaram island, Hand in Hand Inclusive Development and Services, a non-profit company, worked on Solid Waste Management. After they initiated the "Green Rameswaram" Project, ONGC (Oil and Natural Gas Company), offered funding to conduct another project in Thangachimadam Village Panchayat for Solid Waste Management. Their project involves hiring green workers for door-to-door waste collection, conducting cleaning drives on the beach and organising behaviour change communication activities for various stakeholders (Vasudeo et al., n.d.).

Despite all that, there is still a lack of awareness of segregation in households which makes it difficult for panchayat workers to manage waste. Composting is done by a joint effort of the Pamban and Thangachimadam panchayat units. Daily 1-tonne waste is collected. Apart from low wages, which is Rs. 3600 per waste collector, plastic is the biggest problem mentioned by the Panchayat in terms of SWM.

4) Olaikuda's Governance:

Olaikuda comes under Rameswaram Municipality jurisdiction. No one from the municipality comes to collect waste from the village. Upon interviewing the municipality, it was found out that they do not have enough resource persons to deal with SWM. There is door-to-door collection and segregation across 21 wards. One of their biggest issues is cloth dumping in Rameswaram temple, which they try dealing with using behaviour change communication. The micro-composting centre exists where wet waste is sent to. Dry waste and plastic collected by their workers are either sent to local scrap shops or to cement factories. Weekly 7 tonnes of waste is collected. There is no waste collection from schools, colleges and medical institutions.

## 2. WASTE RECYCLERS AND PLASTIC VALUE CHAIN

In Material Flow Analysis of solid waste, dumping is the least favourable action while “rethink” and reduce tops the hierarchy of favourability. Recycling falls in the middle of the favourability hierarchy (Doru & Giușcă, 2010). The diagram above is taken from the ‘Compendium of WHO and other UN guidance on health and environment’. Waste management value chain mapping and analysis help to identify the sources and types of waste generated, as well as the flow of waste from its generation to its final disposal. This information can be used to identify opportunities for waste reduction, reuse, and recycling, which can help conserve resources, reduce environmental pollution, and create new economic opportunities.

The Report by UNDP titled “Solid Waste Value Chain Analysis- Irbid and Mafraq- Jordan” states that "Information on the recycling industry in Jordan is difficult to track and triangulate due to the lack of systematic data collection at government and associative levels combined with the predominance of the informal sector in many recovery activities". This was observed in Ramanthapuram district as well.

In developing countries like India, the Philippines, Vietnam and Indonesia, there is a growing population with consequently growing waste and limited infrastructure. This brings a heavy reliance on the informal sector to collect and recover recyclables (*The Role of Gender in Waste Management*, 2019). Out of the 16 recyclers interviewed, only one had a female heading the shop, and that was a family-owned business. This means that most of the female participation is limited to unregulated employment and informal work, with them engaged primarily as daily wage workers. Slowly, India is providing benefits of formal employment to women (Pandey, 2023; *What’s The Connection Between Gender And Waste Management?* n.d.). Women in India have low Economic Participation and Opportunities. This is one of the reasons why India was ranked 135 during the Global Gender Gap Report 2022 by the World Economic Forum (*Global Gender Gap Report 2022*, 2022). All the participants arranged for FGD on household waste generation across all four villages were female, which indicates that even disposal behaviour is gendered (*The Role of Gender in Waste Management*, 2019).

Across all villages, wet waste (biodegradable waste) forms most of the waste by weight. They generate 1.0-1.5 kg of wet waste per day. By volume, plastics take the lead where they can reach

as large as half a 20L bucket every week. Since the interview was in the summer, a lot of plastic was generated because of the consumption of PET bottles. Despite a single-use plastic ban in the country, there is still prevalent usage in the country, including these four villages (*Ban on Single-Use Plastics*, n.d.). Villagers reported how the local shopkeepers are caught and fined for selling single-use plastic such as plastic carry bags. They must not be punished for this, the responsibility must be shifted upstream via Extended Producer's Responsibility of Plastic Waste Management Rules 2016 (*Centralized EPR Portal for Plastic Packaging*, n.d.).

As for strengthening economic health, MNREGA has played a pivotal role across many villages in India. One such example is Karaikudi. Through MNREGA the villagers created marketable organic fertilizer-producing units. This empowered not just the people but also the village panchayat with a new source of revenue. Such systems can form better bonds between stakeholders and improve the SWM chain while promoting livelihood betterment (*Solid Waste Management and Vermi-Composting through MGNREGS – Better Mahatma Gandhi NREGA*, n.d.).

A) WASTE COLLECTOR'S PROFILING:

- In all four villages, MNREGA workers contribute to waste collection and segregation.
- Panchayat of Karangad, Morepannai, Thanneer Ootru and Olaikuda hire four waste collectors and pay them a meagre Rs. 3600 which is the standard government salary provided.
- Plastic and dry waste collection happens almost daily when men drive vans, announce on the speaker and almost every household gives their waste in exchange for money or new plastic products. Such collection exists in Karangad, Thanneer Ootru and Olaikuda. Morepannai is the village where waste collection has not been done in the last few years.
- One informal waste picker was interviewed in Pamban on Rameswaram island. He had a bike with an attached cage to carry large plastics and dry waste. He goes from house to house buying plastic and other dry waste and selling them new plastics at a discounted rate and makes a profit out of this. The waste collected is sold to plastic recycler shops in

Pamban. Municipality workers are frequently seen in the town and main areas of Rameswaram Island and Ramanathapuram City collecting and stashing garbage.

- One ragpicker was interviewed and said that he collects roadside garbage and sells it to Pamban scrap shops.
- Villagers from all four study areas reported that the fishing net sellers collect the damaged nets themselves and there is a separate recycling system exclusively for fishing nets. Plastic recyclers interviewed pointed towards Sun Polymers in Madurai who are known to recycle plastics. Upon interviewing them, no answer was given to what they do with the fishing nets and how they recycle them.
- Some recycler shops collect household waste themselves while most of them have informal waste pickers delivering waste to them.

B) RECYCLER MAPPING

16 L1 and L2 recyclers were interviewed in Rameswaram island, Uchipuli and Uppur.
No waste is wasted- every dry waste is collected and recycled. The definitions of L1, L2 and L3 are described in Figure 4.

All study villages except Morepannai have private plastic recyclers who come in vehicles to buy plastic from the villagers. Some of them offer a replacement. There are formal waste collectors, informal waste collectors, L1 scrap shops, L2 scrap dealers and L3 waste recyclers who are involved in plastic recycling (refer to Figure 3). Some of the dry waste includes PVC, white ABS, black ABS, HDPE, LDPE, PP, colour PP, milk-white PET, green and transparent PET and tonic bottles. Rameswaram municipality sells their dry waste to HVA Chemical Solutions. Fishing nets have an exclusive system of their own where the fishers sell the nets or the fish net sellers come to collect the nets themselves and give them to L3 recyclers (Sun Polymers) in Madurai.

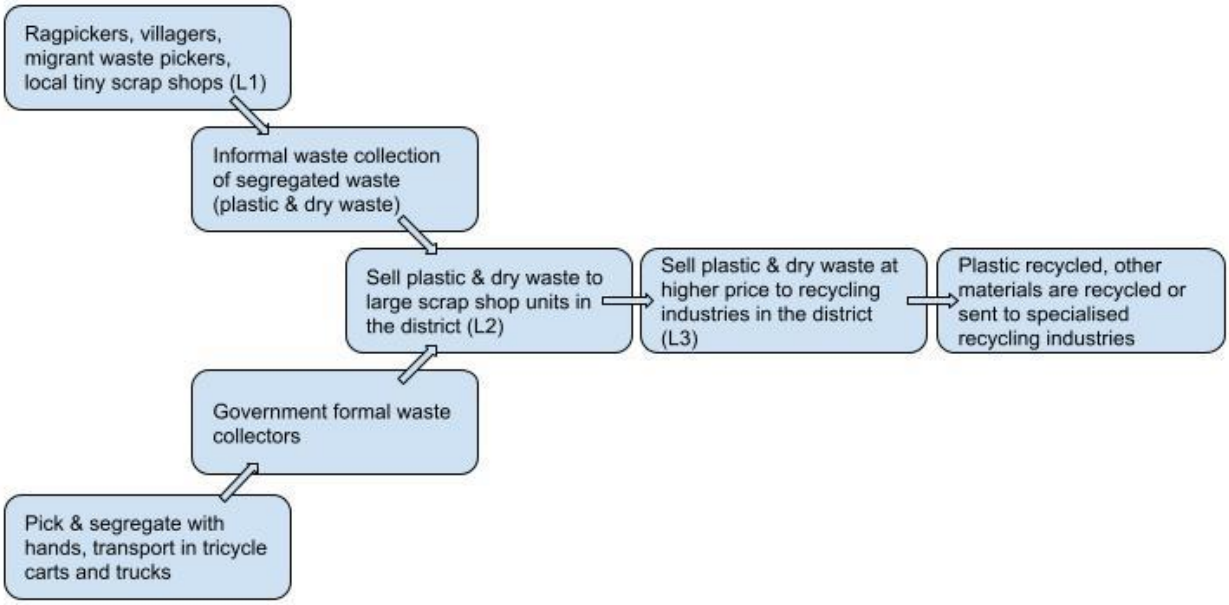
Ragpickers, villagers, migrant waste pickers, local tiny scrap shops (L1)
Informal waste collection of segregated waste (plastic & dry waste)
Sell plastic & dry waste to large scrap shop units in the district (L2)
Sell plastic & dry waste at higher price to recycling industries in the district (L3)
Plastic recycled, other materials are recycled or sent to specialised recycling industries
Government formal waste collectors
Pick & segregate with hands, transport in tricycle carts and trucks

*Fig 5: Recyclers classification and the flow of plastic and dry waste*

There exists "plastic seasons" when strong winds bring in lots of plastic waste and lots of temporary recyclers set up shops on Rameswaram-Dhanushkodi road to collect waste from Dhanushkodi beach.

An issue that the L1 and L2 recyclers face is that some of them do not have a certificate from the fire department which made some of them wary of being interviewed.

The majority of waste from the recyclers is sent to Madurai at Rs. 3/kg profit margin. Roughly 700 kg- 1 tonne of plastic and dry waste is sent weekly from each L1 and L2 recycler to Madurai. The average plastic pricing is plastics being bought at Rs. 12/kg and sold at Rs. 15/kg. The prices can change daily. Rains can ruin dry waste and reduce its price which happened to

one of the recyclers who bought the dry waste for Rs. 16 and had to sell it at a low price of Rs. 9. During the rainy season PET bottles are costlier in price as the consumption is also low.

The usual process of the plastic recycling process is segregation and colour sorting, hot wash with caustic soda, crushing shredding and compounding to form reusable material like DANA and reselling it to mould into other plastic products like dolls. Waste after Madurai goes to Delhi, Gujarat, Coimbatore and Chennai where plastics are remoulded, recycled or incineration and/or sent to the dump yard.

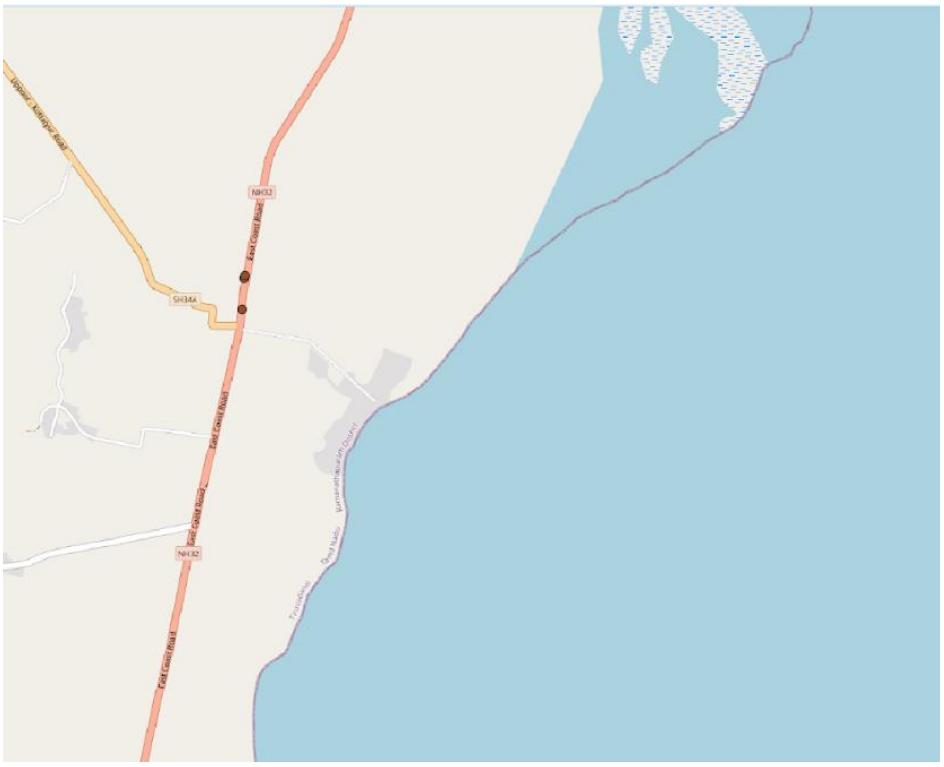


*Fig 6: Three L2 recyclers at Uppur*

*Fig 7: Fourteen L1 and L2 Recyclers in Pamban, Thangachimadam and Rameswaram*

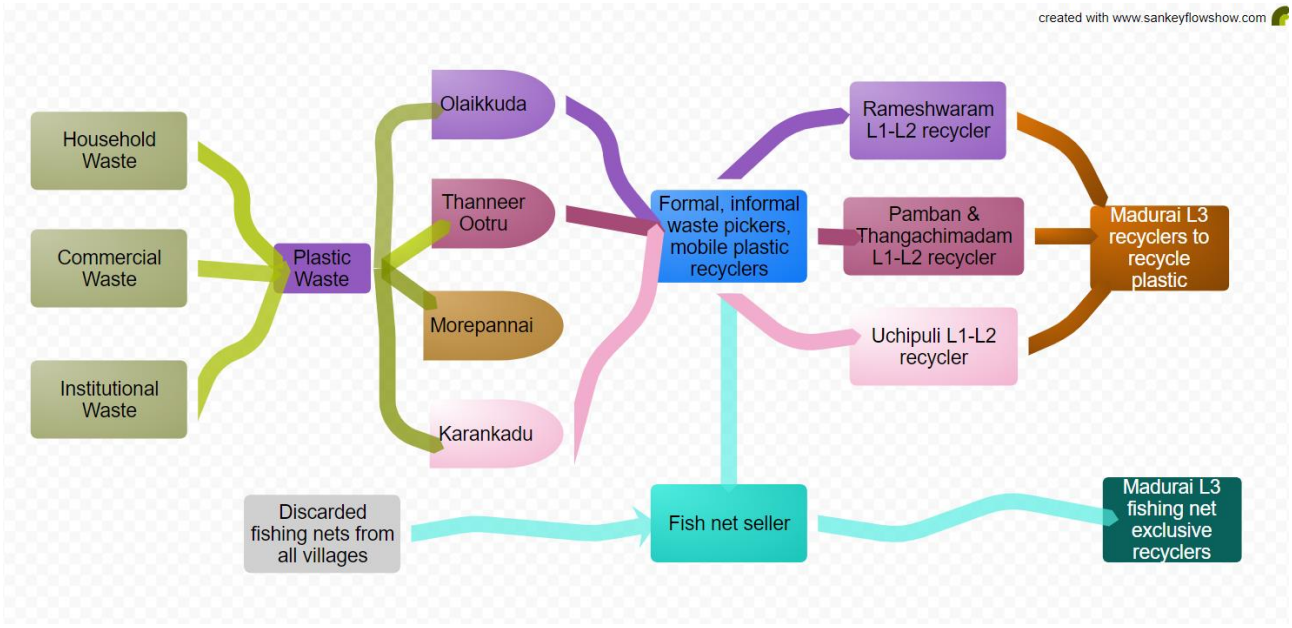


*Fig 8: Sankey Flow chart of the plastic value chain*

Most of the plastics from Olaikuda, Thanneer Ootru and Karangad are collected and recycled as shown in the above flow chart. Morepannai has minimal to no waste collection – villagers dump the plastics along with other wastes in a nearby open area. The scope for bringing sustainability, improving SWM and boosting plastic recycling in Ramanathapuram and the four study sites is

high. As a coastal district with a high floating population of tourists in Rameswaram, plastics are aplenty and a better, collaborative system can drive the waste in the right direction.

## 3. CONCLUSION

The major functional elements in a solid waste management process are collection, segregation, storage, transportation, treatment and disposal. The most crucial step, waste collection, is where the biggest issue lies in the four study areas. There is no daily collection of household waste. At the most, weekly once collection happens. Consistent waste collection exists only in Thanneer Ootru village which comes under Thangachimadam Panchayat. In Morepannai village there is almost zero waste collection happening. Thanneer Ootru village receives waste from tourists which is a huge source of waste in Rameswaram island, found mostly on roads and outside the dustbins.

Solid waste disposal in Karangad barely happens- few panchayat-hired and MNREGA workers collect waste from common points in the village but there is no collection seen from the Thiruvadanai Municipality. Morepannai villagers dispose waste around their houses and in dumping grounds near their beaches which is laden with plastic and other wastes. Villagers of Thanneer Ootru give their waste weekly to the Thangachimadam Panchayat waste collectors. Olaikuda has community dustbins but Rameswaram Municipality workers do not frequently visit the village to collect waste. They instead burn their wastes in common lands. All the FGD participants from all villages unanimously agreed that they need daily waste collection for their wellbeing.

All panchayats offer Rs. 3600 to the waste collectors. There are ragpickers and private waste collectors as the informal waste collectors. There is a lack of awareness of segregation methods and the importance and composting in all villages. Awareness campaigns for segregation and capacity building for composting, plastic recycling and fish net management can help improve waste management practices and benefit the people and the environment.

The strengths of the villages are their active participation by women and vocal local leaders. The threats that come up in all the villages due to improper waste management practices are threats to public health and environmental health. The collaboration of the non-profit organisation Hand-in-Hand has generated a positive effect on Thangachimadam panchayat which is collecting waste daily, hitting a target of one day of collection in a week for each village. There is very little representation of women in the plastic recycling chain, yet, all the volunteers from the village were women who came to discuss household waste management. Engendering local networks will help improve waste management practices in Ramanathapuram District. Most of the informal waste pickers have migrated for job opportunities, as there seem to be very less locals working to collect waste in the four villages.

The 18 local scrap shops in Rameswaram island, Uchipuli and Uppur work relentlessly with the help of formal and informal waste pickers to segregate dry waste and sell it to bigger processors in Madurai, as dry waste has economic value. Per kg of dry waste is sold at around Rs. 12. Wet waste is mostly thrown in the backyards of the villagers. Compost, which is of economic value, is not practised in all villages, as there is low awareness among the villagers. Plastics are a huge part of the waste management system, mainly managed by the private sector. Fishing nets have a separate recycling system which is not accessible to non-fishers and non-locals- the system is tight, and the company managers are tight-lipped. There are no clear government records of them, and no reports on the internet either.

Living among waste causes public health issues. Improper waste management, especially plastic waste and ghost nets causes environmental issues. These issues persist in the study areas. With awareness campaigns across all sections of the villages, mapping the plastic value chain system deeper, capacity building of stakeholders, notifying major polluters in the villages and Ramanathapuram District using Extender Producer Responsibility and better collaboration with the government bodies and local bodies, waste management practises can be improved in the rural coastal villages of Ramanathapuram, Tamil Nadu.

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## X. APPENDIX

1. Codes used for the qualitative analysis of 16 recyclers' semi-structure interviews:

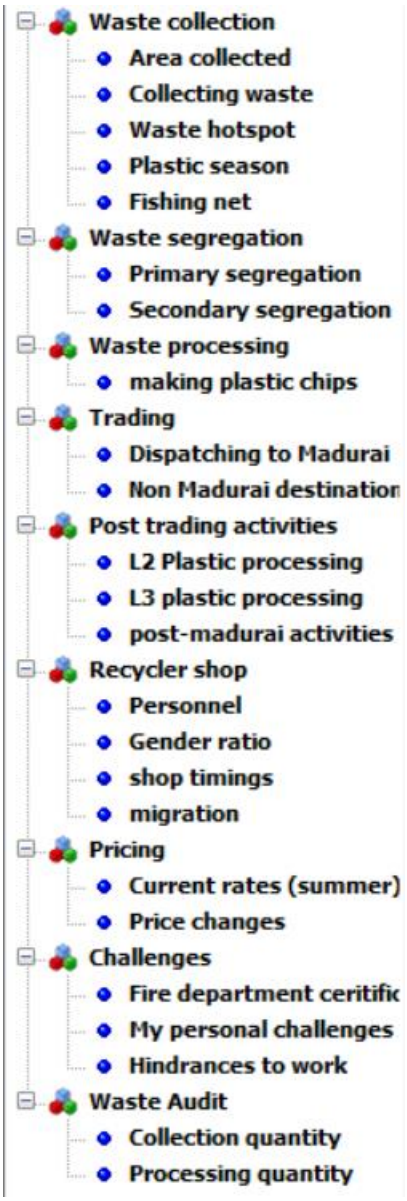


*Figure 8: Codes used to analyse semi-structured interviews with 16 recyclers in Ramanathapuram District*

2. Overview of religion practised in the four study villages

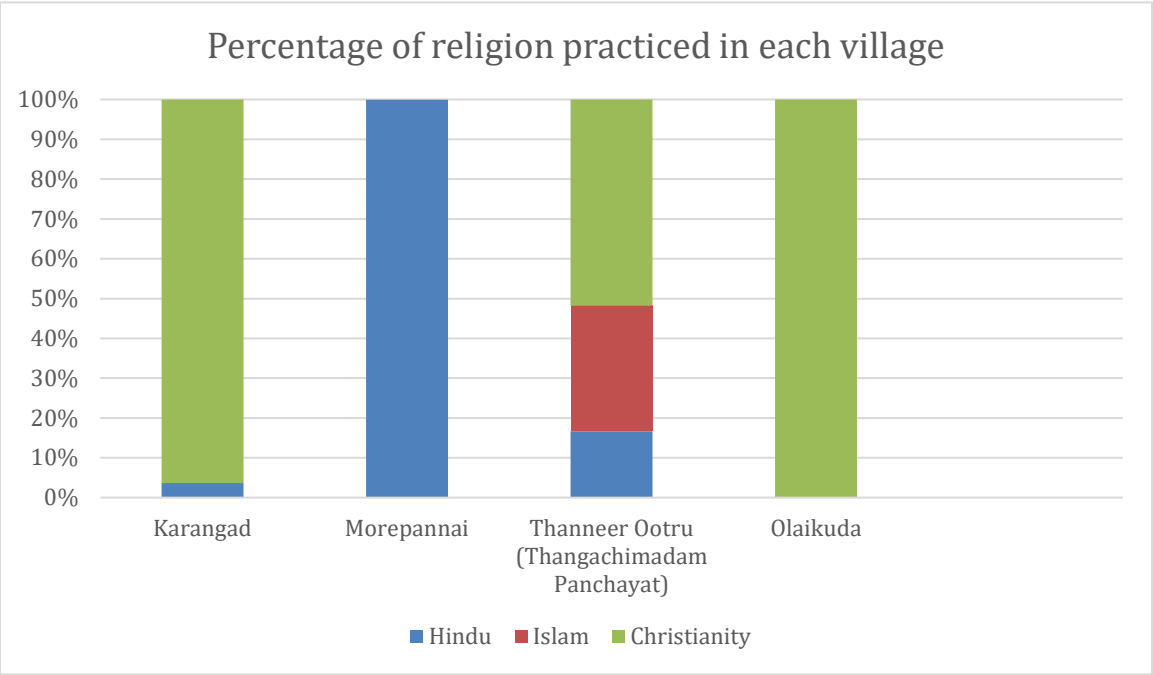


*Figure 9: Percentage of different religions practised in each village. The three religions observed were Hinduism, Christianity and Islam.*

3. Question Cues for Panchayat Interviews:

    a) Does household-level segregation take place?
    b) Is there enough awareness about plastic recycling?
    c) What happens to household, institutional, commercial and medical waste generated?
    d) SWM:

- How is Rameshwaram/Thangachimadam waste collected?
- Who is collecting the waste?
- Where are the waste collectors from?
- What is the frequency of waste collection?
- Does waste segregation take place?

    e) Quantity:

- Where is the waste collected and kept?

- Where does the waste go?
- How much waste is generated and collected?
- What happens to plastic after collection?
- How much plastic is collected, shredded and sold?

f) Livelihood:

- Is there any composting activity?
- Is biogas unit economically viable?
- How is tourist-generated plastic waste managed?
- How much is the plastic waste bought for?
- How much is the plastic waste sold for?

g) Dumpyard:

- What happens at Rameshwaram dumpyard?
- How can we access the place?

4. Question cues for interviews with L1 and L2 recyclers:

a) What happens (with plastics) in your shop?
b) What types of plastic and waste do you collect?
c) What plastics are collected and segregated?

- Areas in Ramnad where plastics are collected?
- What happens to the waste that's not collected from the villages?
- Is fishing-related plastic waste collected? How?

d) How much quantity of waste is being collected per week?

- How much of it is segregated and shredded?
- How much is not recycled?
- What happens to the unsegregated, unshredded waste?

e) Payment:

- How much do you buy plastic for (Type/Kg)?
- How much is the plastic sold for (Type/Kg)?

f) Thanneer Ootru, Olaikkuda, Morepannai, Karangad- do you know anyone collecting from these villages?

g) Who comes to your shops

- Where are they from?
- How many men aggregators?
- How many women aggregators?
- Frequency of their visit?

h) Waste collectors:

- Do you have the profiles of individual waste collectors?
- How can I contact these waste collectors?
- Is there any specific rate for rag pickers or direct household

i) Timings of your shop

- *Also asked them their name, shop name and when they started the shop*

5. Question cues for interviews with L3 recyclers:

*Responder name, shop name, and shop opening date, and give a brief description of the study sites*

a) What do you do with the general "waste" you receive?

b) What types of plastic and waste do you collect?

c) Plastic picture:

- From where does the plastic waste come?
- Do you get fishing-related plastics like nets?
- What happens to plastics in Madurai recycling units?
- Where does plastic go after Madurai?
- In what form does it go?
- What happens next?

d) Process of plastic collection

- What is the rate of plastic and waste you receive?
- Is it segregated?
- Does any further segregation take place?
- From which area do most plastics come from?

- What type of plastic is dominating?
- What is the price of plastic per kg?

e) Processing

- What is the process of making it recyclable?
- Are there any non-recyclable plastics?
- What happens to the waste that is not recycled?
- How much quantity of recycling (in tonnes or MT) happens in one day?
- What are some challenges faced at this step?
- How much is the processed plastic sold for?

f) Where do you think plastic ends up finally? (1. final disposal, 2. export, or 3. re-introduction into the productive process)

g) Are there women workers in this place?

h) How do you think waste is managed in Tamil Nadu?

i) Do you think plastics pose a problem to people and the environment?

6. The questionnaire used for FGD in four villages:

Type of respondents (key informants) required: representatives of the village

A) Give us some information on primary waste collectors in your village. (formal/informal) *(Ungalude oor-la/veetu la kuppai collect panra aala patthi konjam solla mudiyuma?)*

-Waste collectors profiling:

a. Who comes to collect waste? Frequency?

b. How many ragpickers coming to your place? Frequency?

c. How many tricycle collectors coming to your home? Frequency?

d. How many PP resellers coming? Frequency?

e. How many trucks visiting the village? Frequency?

f. Can you give us the contacts of the waste collectors?

B) How many bins are there in your locality? *(kuppai thotti)*

C) Do you burn waste at your home? Why? *(neenga kuppaikalai erikkiringala? )*

D) Are you aware of the role of Gram Panchayat in SWM? *(Thidakkaivugal melanmai)*

E) How much waste do you generate at your home?

-Household waste profiling:

a. Organic waste *(Makkum kuppai)*

b. Plastic waste *(Makkatha kuppai)*

c. Other wastes (tyres, paper, electronic waste, construction waste)

F) Is waste segregation practised?

G) What are the major sources of plastic in your village -

1. Groceries *(kaaygarikal)*
2. Snacks
3. Plastic home appliances
4. Fishing gear *(Mīṉpiṭi upakaraṇaṅkaḷ)*

H) What happens to the organic waste that you are generating?

5. Do you know about composting? *(uram-aakudal)*
6. Is it practised anywhere? (any SHGs?)
7. Would you be interested in separating your waste to produce compost?

(note: SHG, MNREGS encourages job formation to exclusively collect organic waste and sell compost)

I) Do you think segregation and recycling will help (with SWM, with livelihoods, or with the environment)?

J) Major sources of waste in your village (like tourist/commercial activities or village public)

K) What do you think happens in the long term to the waste generated and the environment? *(kuppai karanam iyarkai la enna aagum)*

(extra Qs: NREGA, WTP for improved SWM services, SHGs for recycling, Do you dream of a plastic-free village? (kuppai llama edam patthi kanavu kaanikareengala)

7. Pictures from the field:

*Figure 10: Focus Group Discussion with villagers of Thanneer Ootru*

*Figure 11: Fisherfolk in Olaikuda village*

*Figure 12: Recyclers of Thangachimadam having their evening tea*

*Figure 13: FGD in Morepannai village*

*Figure 14: FGD at Olaikuda village*

*Figure 15: Mangrove Plantation at Karangad Ecotourism Centre on World Forest Day 2023 (21st March 2023).*

*Figure 16: Marine biodiversity and plastic waste segregation awareness camp by Dakshin Foundation in Government Higher Secondary School, Mandapam*

*Figure 17: "Intha kuppai dhan engaloda kanji" (roughly translates to this waste is our porridge). Recycler who travels over 100 kilometres a day explains how collecting waste is their source of livelihood*

*Figure 18: A common view in Ramanathapuram- plastic, Prosopis and panai maram (palmyra palm)*

*Figure 19: Unused dustbins in Rameswaram island- this forms one of the common issues reported in all four villages, where people dump waste around the dustbin, not inside it*